

Using an Assistive Technology Toolkit to Promote Inclusion

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Abstract Although the use of assistive technology for young children is increasing, the lack of awareness and the lack of training continue to act as major barriers to providers using assistive technology. This article describes an assistive technology toolkit designed for use with young children with disabilities that can be easily assembled and implemented by early childhood professionals. Specifically, we will describe assistive technology tools that support young children's participation in their daily activities that involve movement and sensory needs, communication, and interaction with materials and offer strategies on how to implement these devices. An assembled toolkit that allows young children with disabilities immediate access to experiences that lead to acquisition of skills they need to learn and grow is discussed.

Keywords Assistive technology · Communication · Disabilities · Inclusion

Assistive technology (AT) promotes children's learning and development by allowing children to more effectively participate in activities and routines in their natural

environments (Langone et al. 1999; Mistrett et al. 2005). AT devices, ranging from low-tech (e.g., adapted spoons, switches, picture boards) to high-tech (e.g., computers, augmentative communication systems, power wheelchairs), can increase young children's options and facilitate their physical and social inclusion in various settings (Judge and Lahm 1998). Children use AT to access standard learning tools to participate on an equal basis with peers in their various environments. Despite the reported benefits of AT, these devices remain underutilized and poorly integrated into Individual Education Plans (IEP) for young children with disabilities (Dugan et al. 2006; Lesar 1998).

The AT Toolkit Approach

A significant challenge that early childhood professionals face in serving young children with disabilities is acquiring AT equipment and related services. One promising solution to assist early childhood professionals in effective AT consideration and implementation is the concept of an AT toolkit (Edyburn 2000; Judge 2006). An AT toolkit is a proactive approach that implements the principles of Universal Design for Learning. Universal Design for Learning provides a "blueprint for creating flexible goals, methods, materials, and assessments that accommodate learner differences" (Center for Applied Special Technology, n.d.). Rather than following an individual child, the AT tools that are associated with daily activities (playing, communicating, exploring the environment, etc.) are available as needed to support many children. Equipping classrooms with an assortment of AT tools thus affords opportunities for a seamless approach to technology integration.

An AT toolkit that anticipates the learning, language, motor and sensory needs of young children would give

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Table 1 Suggested assistive technology toolkit items and features

Purpose of tool	Tool	Features
Communication	Visual schedule, calendar, lists	Pictures or symbols representing a desired activity or task are inserted in a schedule, calendar, or list.
	Picture communication symbols	Ready-made symbol sets for communication and teaching language concepts.
	<i>Boardmaker</i> software	Software program that contains over 3,000 Picture Communication Symbols to make communication displays or educational materials.
	Boards with objects, pictures, symbols	Boards with pictures or symbols to use for communicating, scheduling or choice-making activities.
	Picture symbol display books/boards	Books or boards containing picture symbols that are theme based on everyday activities.
	Talking switches	A single message communication aid when user activates switch.
Movement	Weighted vests	Vests that open down the middle and the amount of weight is adjustable. The heaviness of the vest provides excellent sensory input and often helps increase attention and concentration.
	Positioning devices (sitting, standing, etc.)	Pediatric positioning equipment that provides comfortable and stable support for seating, standing, and positioning needs.
	Adaptive seating	Chairs that are height and depth adjustable with firm backs.
	Adaptive tables and desks	Tables and desks that are height and depth adjustable.
Learning	Adaptive scissors	Easy-grip scissors with loop handles and blunt tips.
	Pencil grips	Soft rubber triangular grip that fit on pencil to help students top position fingers correctly.
	Switches	Switch can be touched anywhere on its surface to operate any adapted item
	Electronic toys	Battery-operated toys that can be used with switches.
	Switch accessible toys/games	Toys or games that have been adaptive so that children can control their movements with capability switches.
	Slant board/clipboard	Desk-sized easel for students who work best in a vertical orientation; slant/clipboards promote better functional postural position and stability.
	Talking books	Digital books available in different formats that allow children to hear the story read aloud.
	Touch screen for computer	Touch screen that mounts on the monitor of the computer; software can be accessed by the touch of a finger to control the computer and interact with software programs.
	Adaptive keyboards	Alternative keyboard that features large, well-spaced keys in high contrast colors to make it easy for users to locate letters and numbers

children immediate access to meaningful experiences and allow them to participate in classroom activities more effectively. Using a survey, Judge (2006) asked early childhood special education practitioners what devices they thought should be included in such a toolkit. The results of this study identified a preliminary AT toolkit that supports young children's participation in daily activities that involve communication, movement, and interaction with materials (see Table 1). Of particular importance is that many of the assistive devices identified as most useful were low-tech.

The purpose of this article is to describe an AT toolkit designed for use with young children with disabilities that can be easily assembled and implemented by early childhood professionals. Specifically, we will describe AT tools that support young children's participation in their daily activities that involve movement and sensory needs, communication, and interaction with materials and offer strategies on how to implement these tools. Although we

recognize that young children with disabilities require AT supports that are responsive to their individual needs as well as incorporate family-centered practices, defining a toolkit that supports the diversity of young children's abilities is a valuable technology integration strategy that can foster the development of technology-enhanced learning environments.

Movement and Sensory Tools

Children have a natural desire to explore their environments. To explore an environment, they must have mobility and body positioning. To address this need, positioning devices, adaptive seating, tables and desks, and weighted vests should be considered part of an AT tool kit. The environment should be structured to promote movement and support for all children. Positioning devices can be used to facilitate play among young children with

Table 2 Assistive technology for positioning

Positioning aids	Comments
Bean bag	Children can be placed in the desired position with the beans conforming to the child for positioning
Bolsters	Pillow-like objects to support various positions
Wedges	A small incline which enhances head control and use of arms/hands in lying position
Mobile stander	An adjustable stander that provides upright positioning; allows for mobility
Prone stander	An adjustable stander that keeps children in a prone position; enhances use of arms/hands
Sidelyer	Children can lie on their left or right side in a secure comfortable position

disabilities with typically developing peers. It is important to make sure each child is in the proper position to enjoy play activities and has the proper supports to be included and to enjoy participation. Supports such as wedges, rolls, and standers can be utilized to ensure that all children are included in various activities. Table 2 lists some commonly used positioning aids for young children.

Adaptive equipment should allow children to socialize in a normal setting with their peers. Adaptive seating devices such as booster chairs, Rifton corner chairs, Sassy Seats, and Kinder chairs will help a child in a seated position to participate in an activity with ease. Adaptive tables and desks that can be adjusted at various heights and positions and allows a child to stand and reach an object or for a wheelchair or adaptive chair to fit underneath are an excellent means of support for the child.

Weighted products, especially weighted vests, provide proprioceptive feedback (the unconscious awareness of sensations coming from receptors in one's joints, muscles, tendons and ligaments) and deep pressure to assist the child to self-calm and relax so that sensory stimulus can be processed. The weights are evenly distributed around the body and help the child become aware of their body and its movement. Individual weight packets can be added to inside pockets to accommodate different children's growth. Although there is limited research in the area of weighted vest therapy, 55% of the sampled early childhood special education professionals indicated that weighted vests were deemed very useful.

Communication Tools

Just as children need increased mobility supports to actively explore their environment, children also need viable communication supports to maximize their experiences within an inclusive setting. These supports seek to enhance, increase, and facilitate communication within the

learning environment. Practitioners echo the importance of communication and language supports. This is evidenced by six of the top ten assistive devices, deemed by practitioners as being most useful in the classroom, being specifically related to communication and language (Judge 2006). By placing the toolkit in the hands of teachers at the very onset, proactive planning and implementation of assistive devices can create readily accessible language and communication activities and learning opportunities from the beginning (Edyburn 2000).

There are hundreds of ways in which switch technology can be used within the classroom to promote the early communication development of children with disabilities. The use of switches can be an excellent strategy to assist in the development of choice-making behavior and in providing opportunities to practice making choices. Single message switches, such as the BIGmack[®] Communication Aid, that use recorded messages to incorporate language into play and other daily activities provide a way for a child to use a voice to communicate. Devices that offer single or multiple message choices are also available. For example, a child can be provided with a choice of two talking switches to answer simple yes and no questions.

Young children with limited expressive communication can be provided assistance through a picture communication system. Children often associate pictures with verbal cues. Software programs like *Boardmaker* (Mayer-Johnson) or *Picture This* (Silver Lining Multimedia) have greatly simplified the process of creating pictures or symbols for communication displays. The use of visual calendars, lists, and schedules help to regulate both the classroom and the children's understanding of their day. A daily picture schedule can be created for any young child who needs a visual representation of what will take place during the day. The schedule can be created so the child could clip the picture upon completion of the activity. In addition, visual supports assist in compensating for many children's poor auditory memory by providing him/her with visual and/or tactile support through alternative representation. Teachers can create interactive calendars, lists, and schedules with the intention of providing increased possibilities for joint attention, turn taking, problem solving, and communicative opportunities.

Communication, whether naturally occurring or with assistive devices, plays a key role in the formation of friendships in inclusive classrooms. Language and communication technology should allow children to make choices, demonstrate their personalities, and participate in class discussions and activities. When *Boardmaker* symbols are used to convey meaningful messages, beyond matters of functions, this allows children to form friendships and play equally with their peers. Communication boards, whether they contain symbols, objects, or actual

photos, provide children with the opportunity to take turns, express ideas or opinions, and transmit feelings.

It is imperative for teachers to “listen” to the language and phrases spoken within the classroom and select those as choices for communication boards. For example, a child will more frequently request “I want a turn” throughout the day than s/he will request to eat or use the bathroom which are old standbys on many boards. Oftentimes more than one communication board is needed within the classroom as the language and communication in the dramatic play area may and should be very unique to the language and communication occurring within the art center. The more interactive a teacher can make the communication, the more consistently and frequently it will be used and accepted within the classroom.

Learning Tools

Learning tools enable young children the ability to play and interact with materials in order to participate in everyday activities. Access to such learning activities within the environment is essential. A critical concept of AT is to continuously support the child’s development by providing tools that address the challenges that may limit his or her ability to play with toys, communicate, participate, and explore the environment. Many AT tools that children use to participate in daily activities can be found commercially or adjusted for use with minor adaptations.

Young children experiencing challenges of grasping pencils and scissors can experience success using pencil grips and adaptive scissors. Pencil grips provide a larger, more comfortable surface area to hold onto. Some pencil grips are designed to ensure correct finger positioning, enable a firm grip and reduce hand strain. Adaptive scissors provide children with fine motor difficulties a means to participate in learning activities that involve cutting. Adapted scissors can shorten the cutting stroke to ease the cutting motion required. Some scissors provide a double set of finger loops so that both the adult fingers and child fingers are using the same pair of scissors. This allows the child to experience the cutting motion and eye-hand coordination while the adult is making the cutting stroke. In addition, some adapted scissors eliminate the need for using fingers altogether and offer a modified paddle that can be pressed to make the needed cutting stroke.

Slant boards can be used to make a variety of learning activities more accessible and visible. They can be used for simple writing or coloring activities that position the page at a slight slant or angle. Slant boards are also useful for positioning books, keyboards, manipulatives and art materials. They are often constructed of lightweight Plexiglas or PVC plastic. Slant boards are portable and very convenient to use around the classroom.

Talking books provide an alternative format to written text. They are often professionally narrated and are found in digital audio formats that can be used with Mp3 players and other portable devices. In addition, talking books for young children have evolved into wonderfully interactive reading materials that consist of multimedia features such as animations, music, sound effects, highlighted text and modeled fluent reading (Labbo 2000). Talking books are available from the Internet, software programs, and battery-operated hardcopy books with computer components. Children have the opportunity to engage and interact with the story characters, words, and pictures within the story page. Interactive talking books can also be created and modified to meet children’s needs by creating them in common software programs such as Microsoft PowerPoint. Some students may need enlarged text, or fewer words on a page for easier comprehension. Talking books allow children an opportunity to engage in story elements and listen to the story over and over again. Such repetition and interactivity can provide meaningful literacy supports.

Since play is essential to the early childhood classroom, accessible toys are a must. Almost all battery-operated toys can be modified to work with a commercial switch. Switches are input and output devices that facilitate interactions with the environment. They can be used to input a signal into a computer, a battery-operated toy, or a communication board. Toys can be adapted with various types of switches so young children with disabilities can operate them in a very simple manner. Such adaptations can encourage all children to play together. Because any battery-operated toy can be used with a switch by interfacing the toy with a switch-battery interrupter, a variety of commercial toys can be successfully adapted for use for children with disabilities. Table 3 depicts the switches most frequently used by young children with disabilities.


Giving children an adapted electronic toy that they can control and manipulate with a switch encourages participation and provides a means of fostering independence and accomplishment, which in turn increases self-esteem. To build interest in electronic toys, it is suggested to begin with highly reactive toys that provide immediate and intense reaction when touched (Mistrett and Goetz 2000). In addition, electronic toys such as paint swirling machines or bubble makers can provide opportunities to interact and engage in play with other children. In addition, there are thousands of switch accessible toys and games available. An outlet is provided for a switch to be plugged directly into the device. Comprehensive information on accessible toys and a toy rating system can be found at www.ableplay.org.

Interacting and engaging in learning environments and instructional games on the computer can be very motivating for young children. Yet, it is important to note that for

Table 3 Commonly used switches

Name/example	Activation	Comments	Vendors
Textured switch 	Light pressure, switch action with an auditory feedback “click”	Size, textures, and contrasting colors are available	Enabling devices Special kids zone Flaghouse
Plate switch 	A low profile switch that only needs light pressure to activate. With a click to signal activation, it rests on a slightly angled platform for easier access	Size and color may vary	Enabling devices Ablenet
Pillow switch 	Pressing the top foam surface activates the Pillow Switch. This switch provides tactile and auditory feedback.	The smooth, soft surface makes this a suitable switch for head or cheek activation. There is easy fastening to a pillow or wheelchair cushion. This switch provides tactile and auditory feedback.	Don Johnston TASH solutions
Rocker switch 	This switch gives you a two-choice system. Users can push the left side down for one choice or push the right side down for another.	Easily programmed and allows for multiple within classrooms. Works well for people learning choice making	Don Johnston Abledata Enabling devices
Wireless switch 	Features a large trackball and slight touch activation	Easily passed between students Fosters turn-taking and sharing	Ablenet Enabling devices
Animal switches 	Light touch activation	Fun and engaging with learners of all ages	Enabling devices
Wobble switch  	Pressure-sensitive joystick single switch designed for use by individuals with severe physical disabilities or spinal cord injury	Switch can be activated by contact from any direction. Can activate an environmental control unit; battery devices through a battery device adapter; a voice output communication aid through a switch jack; a computer and its software through a computer switch interface; or any other type of switch-accessible product.	Abledata Adaptive switch lab Ablenet

Table 3 continued

Name/example	Activation	Comments	Vendors
Saucer switch 	Light touch activation; available in a variety of textures. Switch lights up to provide visual stimulus.	Ideal for students with limited motor abilities	Enabling devices

many young children keyboard and/or mouse use to interact with the computer is very challenging. For some children the physical ability needed to control a mouse is difficult. For others, understanding the relationship between mouse movement or keystroke and what is happening on the computer screen interferes with success. The use of a touch screen eliminates some of the physical challenges and cognitive hurdles of computer input. It enables children to point to the direct source of activity. A touch screen can be either built into the monitor or can be added onto an existing computer monitor. One advantage to a built-in touch screen is that it does not add an additional layer to the monitor's surface and that it cannot be knocked off. On the other hand a built in touch screen cannot be removed. Simply planning up front about the type of computer system and access needed can provide optimum user success.

Adaptive keyboards allow young learners to engage in early writing activities. They provide the option of larger keys and alternative key arrangements such as alphabetical versus QWERTY (i.e. BigKeys keyboards). Color-coded keys enable children to find vowels or consonants easier. In addition, some alternative keyboards, such as the Intellikeys, can provide a large typing surface with overlays that provide a variety of key variations and mouse functions. Intellitools used with Intellikeys provide a customizable computer learning environment through overlays that can take on the size, shape and look of the learning activity at hand. Adapted keyboards minimize the challenge of limited fine motor control and provide an alternative means to computer access.

Conclusion

As we have asserted, one way to increase the incorporation of technology into the early childhood educational experiences is to create an AT toolkit that can address some of the skill deficits of young children with disabilities. As stated previously, assistive devices can create effective

inclusive environments and experiences for young children with disabilities. AT can provide tools of access and enhancement for inter- and intrapersonal development. In essence, creative usage of AT can increase the overall effectiveness of inclusive programs for young children with disabilities. It is quite possible that with improved interaction with others and the environment, children with disabilities can reap the social, emotional, and cognitive benefits provided to all children involved in early learning environments.

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